In the Claims

The claims stand as follows:

1. (original) A method of designing an alternating phase shifting mask for projecting an image of an integrated circuit design comprising:

providing a design of an integrated circuit layout having a plurality of essentially parallel segments of critical width;

creating essentially parallel alternating phase shifting regions aligned with the critical width segments and extending beyond ends of at least some of the critical width segments; and

creating an alternating phase shifting mask based on the alternating phase shifting regions.

2. (original) The method of claim 1 further including enclosing the integrated circuit layout and the alternating phase shifting regions within a boundary, and extending the alternating phase shifting regions to an edge of the boundary.

3. (original) The method of claim 1 wherein centerline spacing of the plurality of critical width segments and the alternating phase shifting regions is an integer multiple of a minimum pitch.

4. (original) The method of claim 3 further including enclosing the integrated circuit layout and the alternating phase shifting regions within a boundary, and extending the alternating phase shifting regions to an edge of the boundary.

5. (original) A method of designing an alternating phase shifting mask for projecting an image of an integrated circuit design comprising:

providing a design of an integrated circuit layout having a plurality of essentially parallel segments of critical width;

enclosing the integrated circuit layout within a boundary;

extending lengths of the critical width segments in the layout;

designating alternating phase shifting regions between the extended critical width segments; and

creating an alternating phase shifting mask based on the designated alternating phase shifting regions.

6. (original) The method of claim 5 wherein centerline spacing of the plurality of critical width segments is an integer multiple of a minimum pitch.

7. (original) The method of claim 5 further including extending to an edge of the boundary the lengths of the critical width segments in the layout.

8. (original) The method of claim 5 further including adding additional parallel lengths of critical width segments to the design of the integrated circuit layout on at least one side of the plurality of critical width parallel segments, and designating alternating phase shifting regions between the additional critical width segments.

9. (original) The method of claim 5 wherein at least two of the critical width segments are co-linear, and further including adding an additional length of critical width segments to connect the co-linear critical width segments.

10. (original) The method of claim 5 wherein the design of the integrated circuit layout includes regions of non-critical width, and further including removing from the designated alternating phase shifting regions the regions of non-critical width before creating the alternating phase shifting mask.

11. (original) The method of claim 5 further including creating a secondary trim mask for the alternating phase shifting mask, the trim mask having opaque mask regions corresponding to the extended portions of the critical width segments.

12. (original) A method of designing an alternating phase shifting mask for projecting an image of an integrated circuit design comprising:

providing a design of an integrated circuit layout having a plurality of essentially parallel segments of critical width and regions of non-critical width, the critical width segments having centerline spacing which is an integer multiple of a minimum pitch

enclosing the integrated circuit layout within a boundary;

extending lengths of the critical width segments in the layout;

designating alternating phase shifting regions between the extended critical width segments;

removing from the designated alternating phase shifting regions the regions of non-critical width; and

creating an alternating phase shifting mask based on the designated alternating phase shifting regions.

13. (original) The method of claim 12 further including extending to an edge of the boundary the lengths of the critical width segments in the layout.

14. (original) The method of claim 12 further including adding additional parallel lengths of critical width segments to the design of the integrated circuit layout on at least one side of the plurality of critical width parallel segments, and designating alternating phase shifting regions between the additional critical width segments.

15. (original) The method of claim 12 wherein at least two of the critical width segments are co-linear, and further including adding an additional length of critical width segments to connect the co-linear critical width segments.

16. (original) The method of claim 12 further including creating a secondary trim mask for the alternating phase shifting mask, the trim mask having opaque mask regions corresponding to the extended portions of the critical width segments.

17. (original) A program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform method steps for designing an alternating phase shifting mask, the alternating phase shifting mask to be used to project an image of an integrated circuit design, said method steps comprising:

providing a design of an integrated circuit layout having a plurality of essentially parallel segments of critical width; and

creating essentially parallel alternating phase shifting regions aligned with the critical width segments and extending beyond ends of at least some of the critical width segments.

18. (original) The program storage device of claim 17 wherein the method further includes enclosing the integrated circuit layout and the alternating phase shifting regions within a boundary, and extending the alternating phase shifting regions to an edge of the boundary.

19. (original) The program storage device of claim 17 wherein centerline spacing of the plurality of critical width segments and the alternating phase shifting regions is an integer multiple of a minimum pitch.

20. (original) A program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform method steps for designing an alternating phase shifting mask, the alternating phase shifting mask to be used to project an image of an integrated circuit design, said method steps comprising:

enclosing within a boundary a design of an integrated circuit layout having a plurality of essentially parallel segments of critical width;

extending lengths of the critical width segments in the layout; and

designating alternating phase shifting regions between the extended critical width segments in the alternating phase shifting mask.

21. (original) The program storage device of claim 20 wherein centerline spacing of the plurality of critical width segments is an integer multiple of a minimum pitch.

22. (original) The program storage device of claim 20 wherein the method further includes extending to an edge of the boundary the lengths of the critical width segments in the layout.

23. (original) The program storage device of claim 20 wherein the method further includes adding additional parallel lengths of critical width segments to the design of the integrated circuit layout on at least one side of the plurality of critical width parallel segments, and designating alternating phase shifting regions between the additional critical width segments.

24. (original) The program storage device of claim 20 wherein at least two of the critical width segments are co-linear, and wherein the method further includes adding an additional length of critical width segments to connect the co-linear critical width segments.

25. (original) The program storage device of claim 20 wherein the design of the integrated circuit layout includes regions of non-critical width, and wherein the method further includes removing from the designated alternating phase shifting regions the regions of non-critical width.

26. (original) An article of manufacture comprising a computer-usable medium having computer readable program code means embodied therein for designing an alternating phase shifting mask, the alternating phase shifting mask to be used to project an image of an integrated circuit design, the computer readable program code means in said article of manufacture comprising:

computer readable program code means providing a design of an integrated circuit layout having a plurality of essentially parallel segments of critical width; and

computer readable program code means for creating essentially parallel alternating phase shifting regions aligned with the critical width segments and extending beyond ends of at least some of the critical width segments.

27. (original) The article of claim 26 wherein the computer readable program code means further includes computer readable program code means enclosing the integrated circuit layout and the alternating phase shifting regions within a boundary, and extending the alternating phase shifting regions to an edge of the boundary.

28. (original) The article of claim 26 wherein centerline spacing of the plurality of critical width segments and the alternating phase shifting regions is an integer multiple of a minimum pitch.

29. (original) An article of manufacture comprising a computer-usable medium having computer readable program code means embodied therein for designing an alternating phase shifting mask, the alternating phase shifting mask to be used to project

an image of an integrated circuit design, the computer readable program code means in said article of manufacture comprising:

computer readable program code means for enclosing within a boundary a design of an integrated circuit layout having a plurality of essentially parallel segments of critical width;

computer readable program code means for extending lengths of the critical width segments in the layout; and

computer readable program code means for designating alternating phase shifting regions between the extended critical width segments in the alternating phase shifting mask.

30. (original) The article of claim 29 wherein centerline spacing of the plurality of critical width segments is an integer multiple of a minimum pitch.

31. (original) The article of claim 29 wherein the computer readable program code means further includes computer readable program code means for extending to an edge of the boundary the lengths of the critical width segments in the layout.

32. (original) The article of claim 29 wherein the computer readable program code means further includes computer readable program code means for adding additional parallel lengths of critical width segments to the design of the integrated circuit layout on at least one side of the plurality of critical width parallel segments, and designating alternating phase shifting regions between the additional critical width segments.

33. (original) The article of claim 29 wherein at least two of the critical width segments are co-linear, and wherein the computer readable program code means further includes computer readable program code means for adding an additional length of critical width segments to connect the co-linear critical width segments.

34. (original) The article of claim 29 wherein the design of the integrated circuit layout includes regions of non-critical width, and wherein the computer readable program code means further includes computer readable program code means for removing from the designated alternating phase shifting regions the regions of non-critical width.